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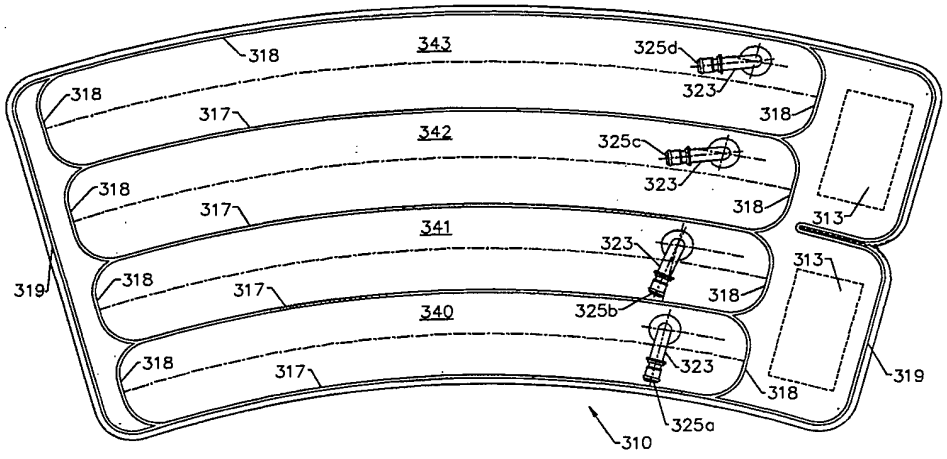

(57) Abstract

A compression system for applying gradient sequential compression of a patient's limb and accelerating deep venous blood flow in the limb from a source of pressurized fluid is provided. The system includes a means for supplying a source of pressurized fluid, said source having a connector interface comprising at least one outlet port, a connector for providing a continuous fluid passageway between the source of pressurized fluid and a compression sleeve. The compression sleeve (310) includes a pair of dimensionally stable, flexible sheets of fluid impervious material, said sheets comprising a thermoplastic film and a fabric applied together into a unitary sheet and means for securing the thermoplastic films of said sheets together along lines (317, 318) defining at least one inflatable chamber (340, 341, 342, 343), disposed longitudinally along the sleeve. A fitting (323) is secured to one of the thermoplastic films of each chamber and in fluid communication with a source of pressurized fluid for inflating the chamber. There is also provided a means (313) for releasably securing the sleeve around the limb of a patient with the chamber encircling the limb.

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COMPRESSION SLEEVE FOR USE WITH A GRADIENT SEQUENTIAL COMPRESSION SYSTEM

BACKGROUND OF THE INVENTION

Field Of The Invention

The present invention relates to a compression sleeve for use with a system for intermittently squeezing a patient's limb to accelerate the flow of blood therein. More particularly, the present invention relates to a compression system having a means for providing a pressurized fluid, a compression sleeve for applying gradient sequential compression to a patient's limb, and a connector for proividing fluid flow between the pressurized source and the sleeve.

Description Of The Prior Art

External pneumatic leg compression reduces venus stasis by intermittently squeezing the leg and accelerating deep venus blood flow. It also enhances blood fibrinolytic activity. Intermittent compression of the leg is effective against venus thrombosis in patients undergoing many types of surgery. The usual treatment is to wrap compressive sleeves having a plurality of pressure compartments around the limb of a patient and then intermittently pressurize the sleeve to successively apply pressure compression to different parts of the limb.

The prior art devices include a variety of compression devices which provide pressure against a

patient's limb through a pressure sleeve which encircles the patient's limb. One of the shortcomings of the compression devices of the prior art is that the chambers of each sleeve are not capable of independent inflation. In some devices pressurized fluid is fed to a first chamber and after a partial inflation air flows to an adjacent chamber through a foam-filled conduit. Another disadvantage of some of the compression sleeves of the prior art is that the devices use air vent openings on the inner side of the sleeve next to the patient's limb to ventilate the limb so that the sleeve will be comfortable. The construction of sleeves of the prior art has been to place an outer sheet over an inner thermoplastic sheet secured only at limited areas. Such sleeve construction does not have good dimensional stability and thus does not retain the best shape during use. In addition, another disadvantage of many of the prior sleeves is that they are not sealed at their outer edges. Yet another disadvantage of the prior art compression sleeves is that some of them do not fit snugly around the patient's limb because the side edges of the sleeve or chamber form a straight line.

SUMMARY OF THE INVENTION

With the foregoing in mind it is therefore a general object of the present invention to provide a compression sleeve for use in a system for preventing the occurrence of deep vein thrombosis and pulmonary embolism in recumbent patients.

Another object of the present invention is to provide a compression system for gradient sequential compression of a patient's limb and accelerating deep venous blood flow therein.

Yet another object of this invention is to provide a compression sleeve made from dimensionally

stable flexible sheets of fluid impervious layers laminated together into a unitary sheet.

It is yet another object of the present invention to provide a compression sleeve having an inflatable chamber shaped in an arcuate manner to more comfortably fit the patient's limb during use.

It is a further object of the present invention to provide a compression sleeve for use in a system and method of regulating compressive forces applied to a limb of a user.

These objects are accomplished by the present invention in which a system for gradient sequential compression of a patient's limb and accelerating deep venous blood flow therein is set forth which provides cyclical squeezing and relaxing action to one or more limbs of a patient. This occurs by sequentially establishing a decreasing gradient of compressive forces along the limbs in a proximal direction. Broadly, the device includes a controller system having a pneumatic compressor, a multi-tube connector and at least one compression sleeve having inflatable chambers encircling (or substantially encircling) a patient's limb.

In particular, the compression system includes one or more sleeves (e.g., calf, thigh, calf and thigh, etc.) which can be wrapped around and releasably secured to a limb of a patient. The sleeves have one or more inflatable chambers therein for retaining pressurized fluid upon inflation and for applying a compressive force to a limb. The compression system also includes a system controller for controlling transfers of pressurized fluid to the inflatable chambers of the compression sleeves during respective inflation cycles, and for venting the pressurized air during respective deflation cycles. Transfers of fluid from the system controller to the

sleeves is preferably provided by a connector having one or more tubes or conduits.

The compression sleeve for applying compressive pressures against a patient's limb includes a pair of dimensionally stable, flexible sheets of fluid impervious material, said sheets comprising a thermoplastic film and a fabric applied together into a unitary sheet such as by laminating. The thermoplastic films are sealed together, such as by conventional heat sealing or other well known means, along lines defining at least one elongated inflatable chamber disposed longitudinally along the sleeve. A fitting is secured to one of the thermoplastic films of each chamber and in fluid communication with a source of pressurized fluid for inflating the chamber. The sleeve has a fastener for releasably securing it around the limb of a patient with the chamber encircling the limb.

According to another aspect of the invention, compressive forces are applied to a limb of a patient by sequentially compressing a distal portion and relatively proximal portion of the limb to provide respective first and second radially inwardly directed compressive forces thereto. The first compressive force is maintained above the second compressive force so that a decreasing pressure gradient is established in a proximal direction along the limb for a preselected time interval. The force is preferably maintained by measuring the compressive forces and adjusting (i.e., increasing or decreasing) the compressive forces to maintain predetermined forces in each sleeve chamber.

In operation, compressive forces are applied to a limb of a patient using a multi-chambered inflatable limb sleeve surrounding the limb. The method includes the steps of pressurizing a first chamber of the limb sleeve to a first predetermined chamber pressure and then pressurizing a second

chamber, disposed proximally relative to the first chamber, to a second preselected chamber pressure, after the first chamber reaches a first threshold pressure. The second threshold pressure may be less than or equal the first predetermined pressure.

Preferably, the second chamber pressurizing step occurs after a pressure in the first chamber has been established at the first predetermined pressure for at least a first time interval. A step is also performed to regulate the pressure in the first and second chambers at their respective predetermined pressures, so that a pressure gradient is established therebetween. The regulating step may also include the steps of measuring a pressure in the first chamber while preventing depressurization of the second chamber and vice versa. Additionally, the regulating step may include the steps of measuring a pressure in the first chamber after it has been inflated to the first threshold pressure and then remeasuring a pressure in the first chamber, after the second chamber has been inflated to the second threshold pressure.

The pressures in the chambers may also be adjusted by performing periodic reinflating steps. Similar steps may also be performed to inflate third and fourth, etc. chambers of the limb sleeve, in sequence, so that a monotonically decreasing pressure gradient is established between the chambers of a sleeve.

BRIEF DESCRIPTION OF THE DRAWINGS

Other objects, features and advantages of the present invention will become apparent from the following detailed description when taken in conjunction with the accompanying drawings in which:

FIG. 1 is a fragmentary perspective view of the compression system of the present invention;

FIG. 2 is a perspective view illustrating the system controller of the present invention with the housing cover removed;

FIG. 3 is an exploded perspective partial view of the multi-tube connector of the present invention;

FIG. 4 is a front plan view of a compression sleeve for use with the compression system of the present invention;

FIG. 5 is a back plan view of a compression sleeve for use with the compression system of the present invention;

FIG. 6 is a fragmentary section view of a compression sleeve of the present invention taken along line 6-6 of FIG. 4; and

FIG. 7 is a front plan view of an alternative embodiment of a compression sleeve for use with the compression system of the present invention.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT

The compression system includes a controller for performing, among other things, real time inflation, monitoring, adjusting and deflation of pneumatic sleeves for gradient sequential compression of a patient's limb and accelerating deep venous blood flow therein. Referring now to FIG. 1, the gradient sequential compression system of the present invention comprises broadly, a controller **10**, a pair of multi-tube conduit connectors **100** coupled to a pair of inflatable four chamber compression sleeves **210** which apply gradient sequential compression against a patient's limb.

Referring now more specifically to FIG. 2 there is shown a perspective view of a preferred embodiment of the system controller of the present invention generally indicated at **10**. As shown in FIG. 2 the system controller **10** includes a housing forming a

base **11** and a cover **13**. The housing includes a control display panel **15**, tube connector outlet ports **17**, and a mounting means **19**. The control display panel **15** is used to visually communicate chamber inflation information (e.g., pressure levels, chamber status), the mode of operation (e.g., one- or two-limb mode) and alarm, alert and fault conditions. The display may also provide means, responsive to actuation by a user or health care professional, for preselecting the desired pressure levels to be achieved during a sleeve inflation cycle. The system controller **10** includes a pneumatic compressor **20** for supplying compressed fluid through valve manifold **30** having a plurality of valves which connect through outlet ports **17**.

As shown in FIG. 3, a conduit connector **100** is provided for rapidly connecting and disconnecting to the controller **10** at outlet ports **17** and to one or more inflatable compression sleeves **210** of the present invention for applying gradient sequential compressive pressures against a patient's limb. The conduit connector **100** includes flexible conduits **110**, connector inserts **120**, couplers **130** and gripping member **140**. In a preferred embodiment, the connector **100** interacts with the outlet ports **17** of controller **10** for interconnecting with each of the sleeves **210**, one for each leg of the patient.

Flexible conduit **110** comprises a plurality of integrally formed tubes **111** in spaced-apart relation. The flexibility of the conduit **110** allows a user to select a position for the controller **10** which is comfortable for the patient and accessible to the operator while conforming to the space available for operating the compression system of the present invention.

In a preferred embodiment, the conduit **110** is made of soft plastic, such as polyvinyl chloride, and comprises four thin-walled tubes **111** of generally

circular cross-section having a first end **115a** and a second end **115b**. Tubes **111** define pneumatic passageways for interconnecting each outlet port **17** of the controller **10** to a respective inlet port **223** for each chamber **240**, **241** of sleeve **210** (FIG. 4).

At a first end **115a**, connector **100** includes a plurality of hollow generally cylindrical connector inserts **120**. The number of connector inserts **120** corresponds to the number of tubes **111** in conduit **110**. Connector inserts **120** may be secured to the ends **115a** of tubes **111** by any suitable means, but are preferably press fit. O-rings **129** form a tight seal with the receiving holes in outlet ports **17** to prevent the pressurized air from escaping at the connections between connector inserts **120** and outlet ports **17**.

At a second end **115b**, connector **100** includes a plurality of longitudinally-spaced sequential quick release couplers **130**. Couplers **130** may be of the type described in United States Patent No. 5,052,725 and do not form a part of the present invention. The number of couplers **130**, however, corresponds to the number of tubes **111** in conduit ribbon **110**. Couplers **130** are secured to tubes **111** at second end **115b** by any suitable means such that couplers **130** are not easily removed from tubes **111**.

Each of tubes **111** has a predetermined length such that couplers **130** are spaced-apart at longitudinal positions which accommodate the locations of the chambers **240**, **241** in sleeve **210** (FIG. 4). In a preferred embodiment, conduit **110** is divided at second end **115b** into four separate longitudinally-spaced ends which are secured to couplers **130** corresponding to each of four tubes **111**. In operation, couplers **130** are releasably attached to corresponding fittings **223** in chambers **240**, **241** to define pneumatic passageways for interconnecting controller **10** and compression sleeve **210** (FIG. 4). Each coupler **130** includes printed

indicia **133** on the body **135** of the coupler which corresponds to like printed indicia **226** on fittings **223** in chambers **240, 241**. Thus, when couplers **130** are properly connected to the corresponding fittings in sleeve **210**, a continuous pneumatic passageway is formed for interconnecting controller **10** and sleeve **210** to accomplish the objectives of the invention in accordance with the aforementioned sequence. In a preferred embodiment, printed indicia **133** and printed indicia **226** are predetermined colors such that couplers **130** and inlet ports **223** in chambers **240, 241** are color-coded.

A gripping member **140** is positioned adjacent first end **115a** of connector **100** for aligning conduit inserts **120** with outlet ports **17** of controller **10**. Gripping member **140** includes a housing formed by top portion **143a** and bottom portion **143b**. Portions **143a** and **143b** are preferably molded of a suitable plastic, but may be formed by any means which accomplish the objectives of the invention described hereafter. Top portion **143a** and bottom portion **143b** are joined together to form the housing. The pneumatic passageways formed thereby provide a continuous passageway for permitting the compressed air from the controller **10** to flow into the chambers **240, 241** in sleeve **210** to inflate the chambers in the aforementioned sequence without directly contacting the grip.

Portions **143a** and **143b** include latching members **180** having inclined gripping surfaces on exterior surfaces. Latching members **180** are formed integrally, for example by molding, with portions **143a** and **143b** such that the latching members pivot about a resilient joint formed along an axis perpendicular to the direction in which conduit **110** passes through gripping member **140**. Latching members **180** are thereby inwardly and outwardly movable in relation to portions

143a and 143b. Latching members 180 include latching lips 185 which interact with slots 18 (FIG. 2) in connector outlet ports 17 for securing gripping member 140, and thus conduit 110, to controller 10. The interaction between latching lips 185 and slots 18 thereby formed provides further transfer of the tensile stresses induced in conduit 110 through gripping member 140 to controller 10.

A user secures connector 100 to controller 10 at first end 115a by first squeezing latching members 180, then inserting gripping member 140 into controller outlet port 17 until latching lips 185 interact with slots 18, and then releasing the latching members so that the latching lips engage slots 18 in controller outlet port 17.

Referring now to FIG. 4, the compression sleeve 210 includes a pair of inflatable chambers 240, 241 suitable to encircle a patient's limb and adapted to render compressive pressures thereto. As shown more clearly shown in FIG 6., the sleeves are formed from a pair of dimensionally stable, flexible sheets 220, 221. Each sheet is made of a soft fabric having a thermoplastic film 211 laminated or applied across its entire surface to form a dimensionally stable and unitary sheet. Alternatively, the sleeve can be a dimensionally stable film having a surface treatment. The thermoplastic film 211 may be formed from a suitable fluid impervious flexible thermoplastic material, such as polyvinylchloride or other suitable thermoplastic. The fabric 212 may be a relatively inelastic fabric of nylon or polyester. It is desirable to use a fabric of a suitable color and preferably a fabric with a brushed matte or napped finish. While nonwoven fabrics may be used, it is preferable to use a knitted fabric. As will be discussed in greater detail hereinafter, a portion of the fabric may serve as one part of the fastener. It

is sometimes desirable that the fabric **212** covers less than the entire surface of the thermoplastic film **211**. In such cases, a non-napped fabric may be laminated to the thermoplastic film and still provide an attractive and comfortable fabric surface for the sleeve.

The sleeve **210** has a pair of side edges **214a** and **214b**, and a pair of end edges **216a** and **216b** connecting the side edges **214a** and **214b**. The sheets **220**, **221** are juxtaposed one on the other at their respective edges and ends with the thermoplastic film **211** facing each other. The sheets **220** and **221** are then sealed together along longitudinal lines **217** and lateral lines **218** to form a plurality of longitudinally disposed elongated inflatable airtight chambers **240**, **241** adjacent each other. The chambers **240**, **241** extend laterally in the sheets **220** and **221**, and are disposed in the longitudinal arrangement between end edges **216a** and **216b**. In addition, the compression sleeve **210** is sealed at seam **219** around the outer periphery of juxtaposed sheets **220** and **221**. When the compression sleeve is sealed at its outer edges by seam **219** the areas of the sleeve outside of the chambers are protected from intrusion of foreign material between the sheets, the area of the fastener is stabilized. When the sleeve **210** is placed on a patient's calf, the lowermost chamber **240** is located on a lower part of the leg near the patient's ankle, while the uppermost chamber **241** is located on an upper part of the leg nearer the knee.

The construction of the sleeve **210** is accomplished by any one or the combination of heat sealing, ultrasonic sealing, sewing, adhesives and the like. There is thus formed a compression sleeve, formed from unitary sheets, having a plurality of chambers **240**, **241** which, as shown in FIG. 4 are adjacent each other. As shown in FIGS. 4-6, there may be some space between the adjacent chambers or the

chambers may share a common seam. The distance between the chambers is a matter of choice depending upon the size of the sleeve and the location on the patient's limb. In an alternative embodiment of the compression sleeve of this invention, each chamber of the sleeve may, if desired, have a different volume which can be adapted to conform to the chamber location on the patient's limb. The pressure in each chamber of differing volumes remains the same because the pressure exerted by each chamber is individually controlled. As shown in FIGS. 4 and 5, in a preferred embodiment, the sleeve **210** and the chambers **240**, **241** may be arcuately shaped to better fit the patient's limb. In addition, it is not necessary that the inflatable chambers occupy the entire longitudinal portion of the sleeve from end edge to end edge. For example, as shown in FIG. 4, the chambers only occupy a majority portion of the sleeve leaving the remainder to be used for other purposes, such as providing a place for positioning a first portion of the fastening means.

Each sleeve **210** has a fastening means for securing the sleeve around the patient's limb. In a preferred embodiment, the fastening means comprises a fastener strip **213** of connecting tabs extending along side edge **216a** of a surface of the sleeve and being releasably engagable to the fabric **212** (depending upon which side of the sleeve the fastener strip **213** is located). The elongated fastener strip **213** may be a hook and loop-type fastening material, such as Velcro®. The fastener strips **213** are preferably affixed to the tabs located on the center line of each chamber **240**, **241** to provide more stability of the chamber when the sleeve is secured around the patient's limb. The fastener strip **213** occupies substantially the entire length of an end edge of a sleeve. In one embodiment of this invention, the fastener strip **213** is connected to the tab portion in an area outside of the chamber.

The dimensional stability provided by the laminated sheets enables the fastener strip, when placed outside the chambers to function without having the ends of the chambers overlaying each other.

Each chamber **240**, **241** has a conventional quick release polycarbonate fitting **223** for rapid connection of couplings **130** to its respective conduit tube **111**. Each fitting **223** has attached to it printed indicia **226** to match the indicia **133** on the conduit coupling **130**. The fitting **223** is preferably secured in place to thermoplastic film **211** by well known means, such as heat sealing. The fluid inlets to chamber fittings **223** may be disposed in line with each other but the fluid inlets **225a** and **225b** are preferably disposed at angles for most conveniently accommodating each coupler **130** of conduit **110**. A separation or slit **225** is provided at end edge **216a** substantially coinciding with the region between adjacent chambers to promote a better fit on the patient's limb.

In another embodiment, the compression sleeve **310** shown in Figure 7 has four chambers **340**, **341**, **342**, **343** suitable to encircle a patient's limb and adapted to render compressive pressure thereto. The compression sleeve **310** has the four chambers, but is otherwise made like and operates like the two chambered sleeve **210** described in FIGS. 4-6. For example, a compression sleeve **310** is formed from a pair of dimensionally stable, flexible sheets with the thermoplastic films facing each other and sealed together along longitudinal lines **317** and lateral lines **318** to form four longitudinally disposed inflatable airtight chambers adjacent each other. The compression sleeve may also be sealed at its outer edges at seam **319**. The compression sleeve **310** may be secured around the patient's limb in a manner similar to compression sleeve **210** using fastening strips **313** located on tabs at one end edge of the sleeve. Each chamber has a

conventional quick release fitting **323** for rapid connection to couplings **130**. The fluid inlet **325a**, **325b**, **325c** and **325d** to each respective fitting may be disposed at a different angle to each other to better accommodate the multi-tube connector.

In operation, the sleeve **210** is wrapped around the calf or thigh and releasably secured. In use, the sleeve **210** may be placed below the patient's leg preparatory for securing the limb. Next, the first fastener means and the second fastener means are passed around the patient's leg. After both the thigh and calf sleeve have been suitably wrapped around the patient's limb, the remaining part of the sleeve adjacent the side edge may be wrapped over the fabric and the fastener strip **213** may be pressed against the fabric **212**. Thus, the fastener strip **213** engages with the brushed fiber of the fabric **212** such that the strips and the sheet engage and retain the sleeve in wrapped configuration. Since the fabric **212** extends entirely across the outer surface of the sleeve **210**, the sleeve may be readily adjustable, as necessary, for the desired fit according to the size of the patient's limb.

After placement of the sleeve on the patient's limb and attached via connector **100** to the controller **10**, the controller may be initiated in order to sequentially supply fluid to the chambers of compression sleeve **210** or compression sleeve **310**. Of course, it is understood that there may be sleeves on each of the patient's legs. The controller **10** intermittently inflates the chambers during periodic compression cycles, and intermittently deflates the chambers through the connector tubes during intermediate decompression cycles as described above.

While the preferred embodiments of this invention have been illustrated in detail, it should be readily apparent to those skilled in the art that other

embodiments may be conceived and fabricated without departing from the spirit and scope of this invention.

THAT WHICH IS CLAIMED:

1. A compression system for applying gradient sequential compression of a patient's limb and accelerating deep venous blood flow in the limb from a source of pressurized fluid, comprising:

a means for supplying a source of pressurized fluid, said source having a connector interface comprising at least one outlet port;

a connector for providing a continuous fluid passageway between said connector interface and a compression sleeve for providing a source of pressurized fluid, said compression sleeve comprising;

an elongated pressure sleeve comprising a pair of dimensionally stable, flexible sheets of fluid impervious material, said sheets comprising a thermoplastic film and a fabric applied together into a unitary sheet, said thermoplastic films of said pair of sheets being secured together along lines defining at least one inflatable chamber disposed longitudinally along the sleeve;

a fitting secured to one of the thermoplastic films of each chamber and in fluid communication with a source of pressurized fluid for inflating the chamber; and

means for releasably securing said sleeve around the limb of a patient with the chamber encircling the limb.

2. The compression system for applying gradient sequential compression of a patient's limb and accelerating deep venous blood flow in the limb from a source of pressurized fluid according to Claim 1 wherein said means releasably securing said sleeve comprises fastening means placed on the outside of and proximate one edge of the sleeve for attachment to said fabric of the sleeve after it is wrapped around the limb of a patient.

3. The compression system for applying gradient sequential compression of a patient's limb and accelerating deep venous blood flow in the limb from a source of pressurized fluid according to Claim 1 wherein said at least one inflatable chamber is a plurality of chambers and said fitting secured to a chamber is a fitting for each chamber for connection to the multi-tube conduit couplers.

4. The compression system for applying gradient sequential compression of a patient's limb and accelerating deep venous blood flow in the limb from a source of pressurized fluid according to Claim 1 wherein said fastening means is formed of a fastening strip of connecting tabs formed at one side edge of said sleeve and said tabs are located at the center line of a pair of adjacent chambers.

5. The compression system for applying gradient sequential compression of a patient's limb and accelerating deep venous blood flow in the limb from a source of pressurized fluid according to Claim 1 wherein said chamber defined by the sheets occupies a majority of the sleeve but leaves a sufficient portion to support a fastening area outside the area defining the chamber.

6. The compression system for applying gradient sequential compression of a patient's limb and accelerating deep venous blood flow in the limb from a source of pressurized fluid according to Claim 1 wherein one portion of the securing means is connected to a sleeve portion outside of the area defined by the chamber.

7. The compression system for applying gradient sequential compression of a patient's limb and accelerating deep venous blood flow in the limb from a source of pressurized fluid according to Claim 1 further comprising said sleeve having at one end edge a separation between the tabs substantially coinciding with the region between adjacent chambers.

8. The compression system for applying gradient sequential compression of a patient's limb and accelerating deep venous blood flow in the limb from a source of pressurized fluid according to Claim 1 wherein said fastener means is a hook and loop-type fastener.

9. The compression system for applying gradient sequential compression of a patient's limb and accelerating deep venous blood flow in the limb from a source of pressurized fluid according to Claim 1 wherein the chambers are immediately adjacent each other, separated only by means for connecting thermoplastic films.

10. A sleeve for applying compressive pressures against a patient's limb and accelerating deep venous blood flow therein from a source of pressurized fluid, comprising:

a pair of dimensionally stable, flexible sheets of fluid impervious material, said sheets comprising a thermoplastic film and a fabric applied together into a unitary sheet, said thermoplastic films of said pair of sheets being secured together along lines defining at least one inflatable chamber disposed longitudinally along the sleeve;

a fitting secured to one of the thermoplastic films of each chamber and in fluid communication with a

source of pressurized fluid for inflating the chamber through a connector; and

means for releasably securing said sleeve around the limb of a patient with the chamber encircling the limb.

11. The sleeve for applying compressive pressures against a patient's limb according to Claim 10 wherein said securing means comprises fastening strip placed on the outside of and proximate one edge of said sleeve for attachment to said fabric of said sleeve after said sleeve is wrapped around the limb of a patient.

12. The sleeve for applying compressive pressures against a patient's limb according to Claim 10 wherein said fastening means is formed of a fastening means located on the center line of a chamber.

13. The sleeve for applying compressive pressures against a patient's limb according to Claim 10 wherein said at least one inflatable chamber is a plurality of chambers and said fitting secured to a chamber is a fitting for each chamber.

14. The sleeve for applying compressive pressures against a patient's limb according to Claim 13 wherein said fittings are oriented at angles with respect to one another to more easily accommodate said connector.

15. The sleeve for applying compressive pressures against a patient's limb according to Claim 13 wherein said fittings are oriented at different angles with respect to one another to more easily accommodate said connector.

16. The sleeve for applying compressive pressures against a patient's limb according to Claim 10 wherein said fastening means is formed of a fastening strip of connecting tabs formed at one side edge of said sleeve and said tabs located at the center lines of a pair of adjacent chambers.

17. The sleeve for applying compressive pressures against a patient's limb according to Claim 10 wherein each chamber of the sleeve has a different internal volume.

18. The sleeve for applying compressive pressures against a patient's limb according to Claim 10 wherein the sleeve has a pair of opposed edges having an arcuate shape.

19. The sleeve for applying compressive pressures against a patient's limb according to Claim 10 wherein the chamber is arcuate shaped.

20. The sleeve for applying compressive pressures against a patient's limb according to Claim 10 wherein the chamber defined by the sheets occupies a majority of the sleeve but leaves a sufficient portion to support a fastening area outside the area defining the chamber.

21. The sleeve for applying compressive pressures against a patient's limb according to Claim 10 wherein the chambers are immediately adjacent each other, separated only by means for connecting thermoplastic films.

22. The sleeve for applying compressive pressures against a patient's limb according to Claim 10 wherein said chambers are of different lengths.

23. The sleeve for applying compressive pressures against a patient's limb according to Claim 10 wherein one portion of the securing means is connected to a sleeve portion outside of the area defined by the chamber.

24. The sleeve for applying compressive pressures against a patient's limb according to Claim 10 wherein said sleeve has two chambers.

25. The sleeve for applying compressive pressures against a patient's limb according to Claim 24 further comprising said sleeve having at one end edge a separation between the tabs substantially coinciding with the region between adjacent chambers.

26. The sleeve for applying compressive pressures against a patient's limb according to Claim 10 wherein said sleeve has four chambers.

27. The sleeve for applying compressive pressures against a patient's limb according to Claim 10 wherein said fastener means is a hook and loop-type fastener.

28. The sleeve for applying compressive pressures against a patient's limb according to Claim 10 wherein said pairs of dimensionally stable sleeves are connected together at their side edges and end edges.

29. A sleeve for applying compressive pressures against a patient's limb and accelerating deep vein blood flow therein from a source of pressurized fluid, comprising:

a pair of dimensionally stable, flexible sheets of fluid impervious material having a pair of

side edges, and a pair of end edges connecting said side edges, said sheets comprising a thermoplastic film and a fabric applied together into a unitary sheet, said thermoplastic films of said pair of sheets being secured together along lines defining a plurality of inflatable chambers disposed longitudinally along the sleeve;

a plurality of fittings one each secured to one of the thermoplastic films of each chamber and in fluid communication with a plurality of conduits for receiving a source of pressurized fluid for inflating each chamber through a connector; and

means for releasably securing said sleeve around the limb of a patient with the chambers encircling the limb, said means comprising fastening strips placed on the outside of and proximate one edge of the sleeve for attachment to said fabric of said sleeve after said sleeve is wrapped around the limb of a patient.

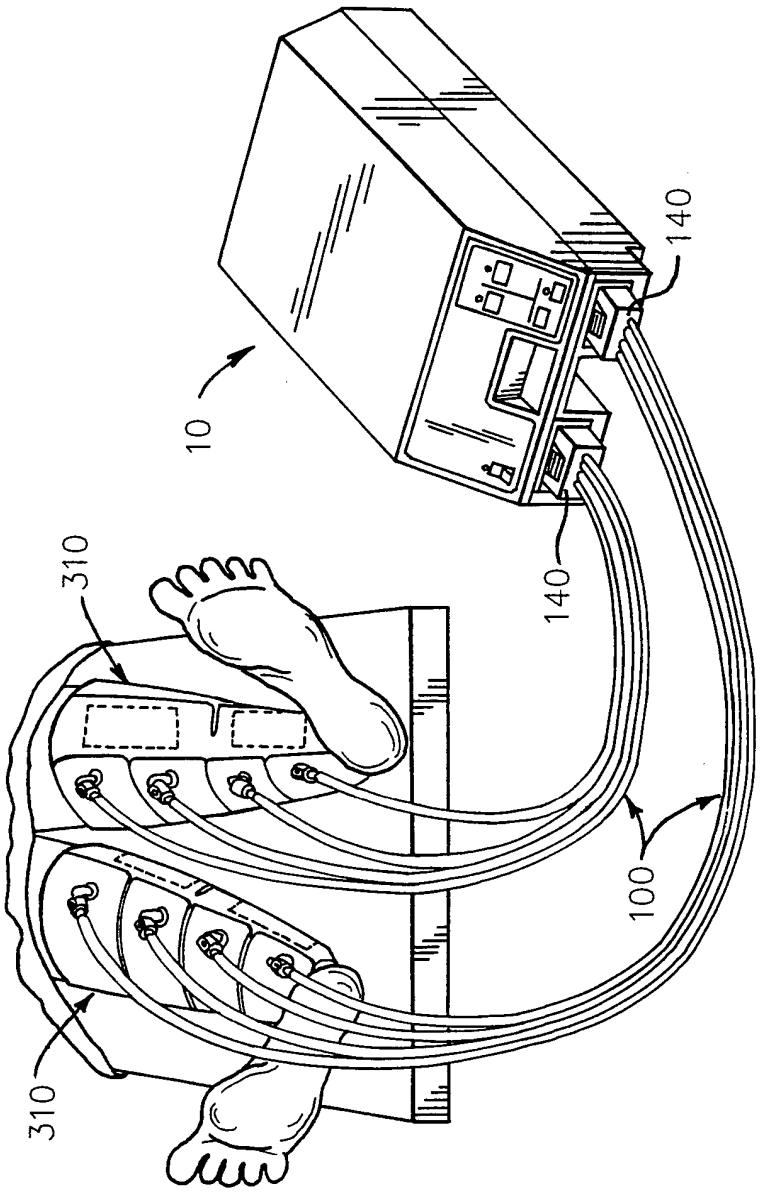

FIG. 1.

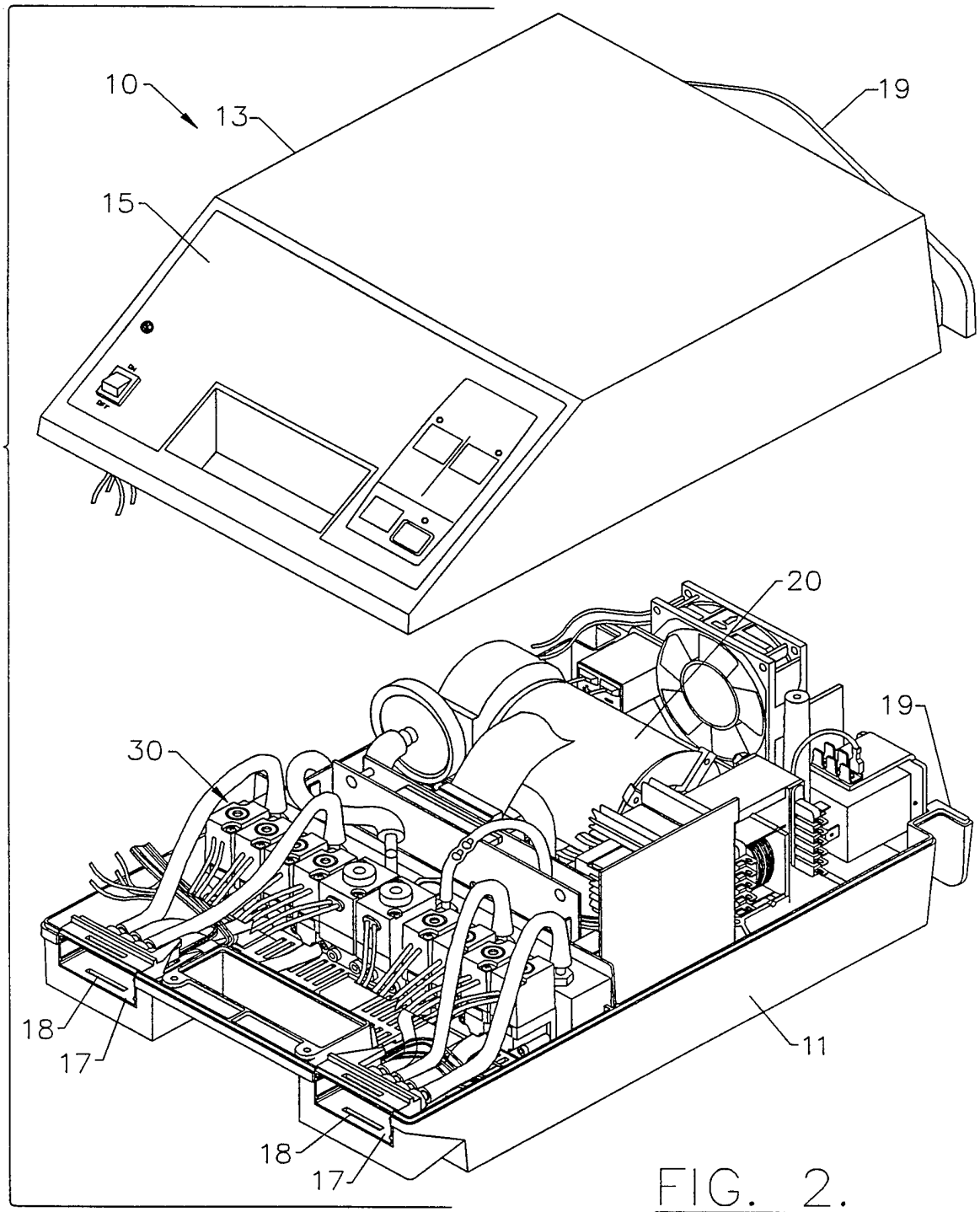

FIG. 2.

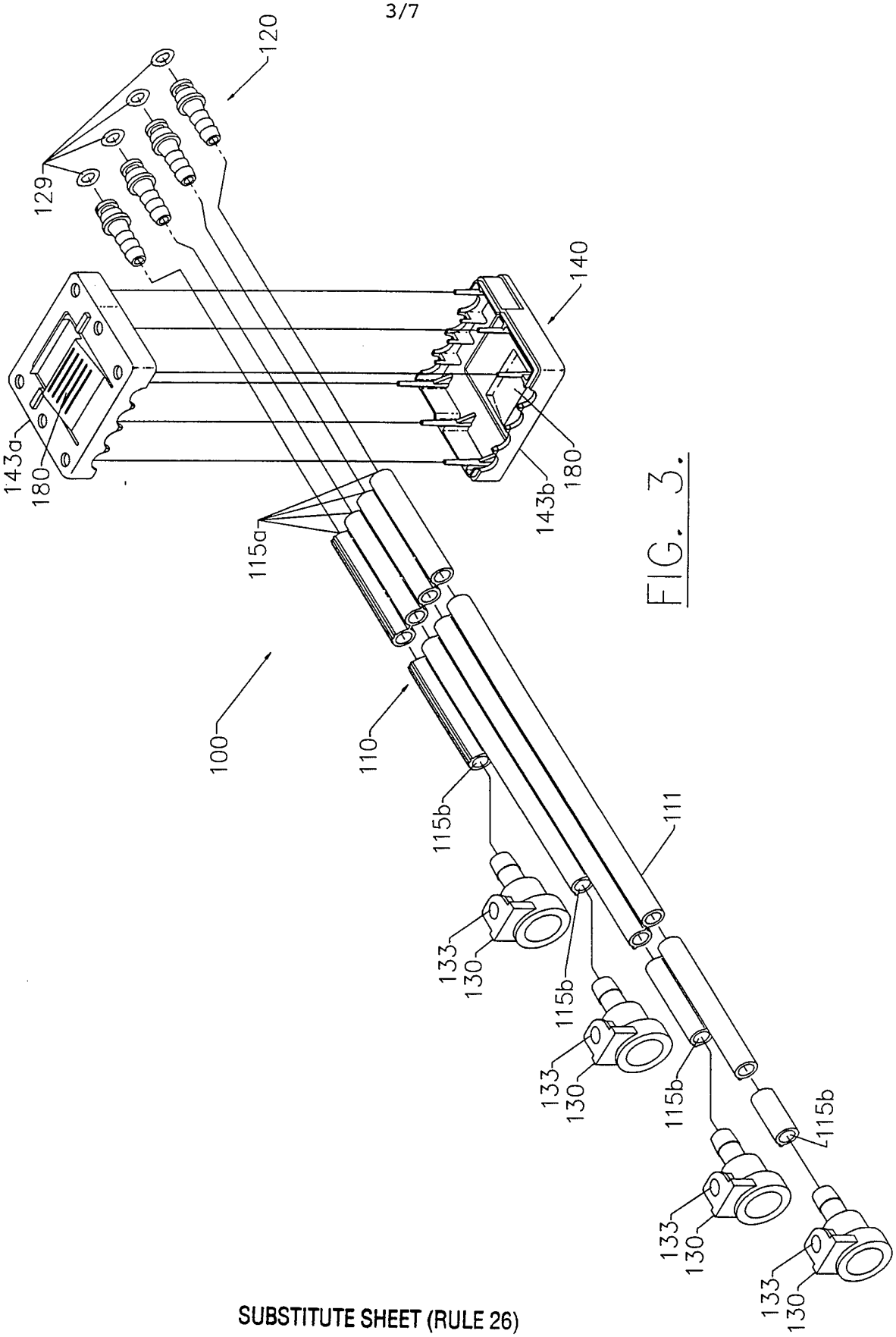
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FIG. 3.

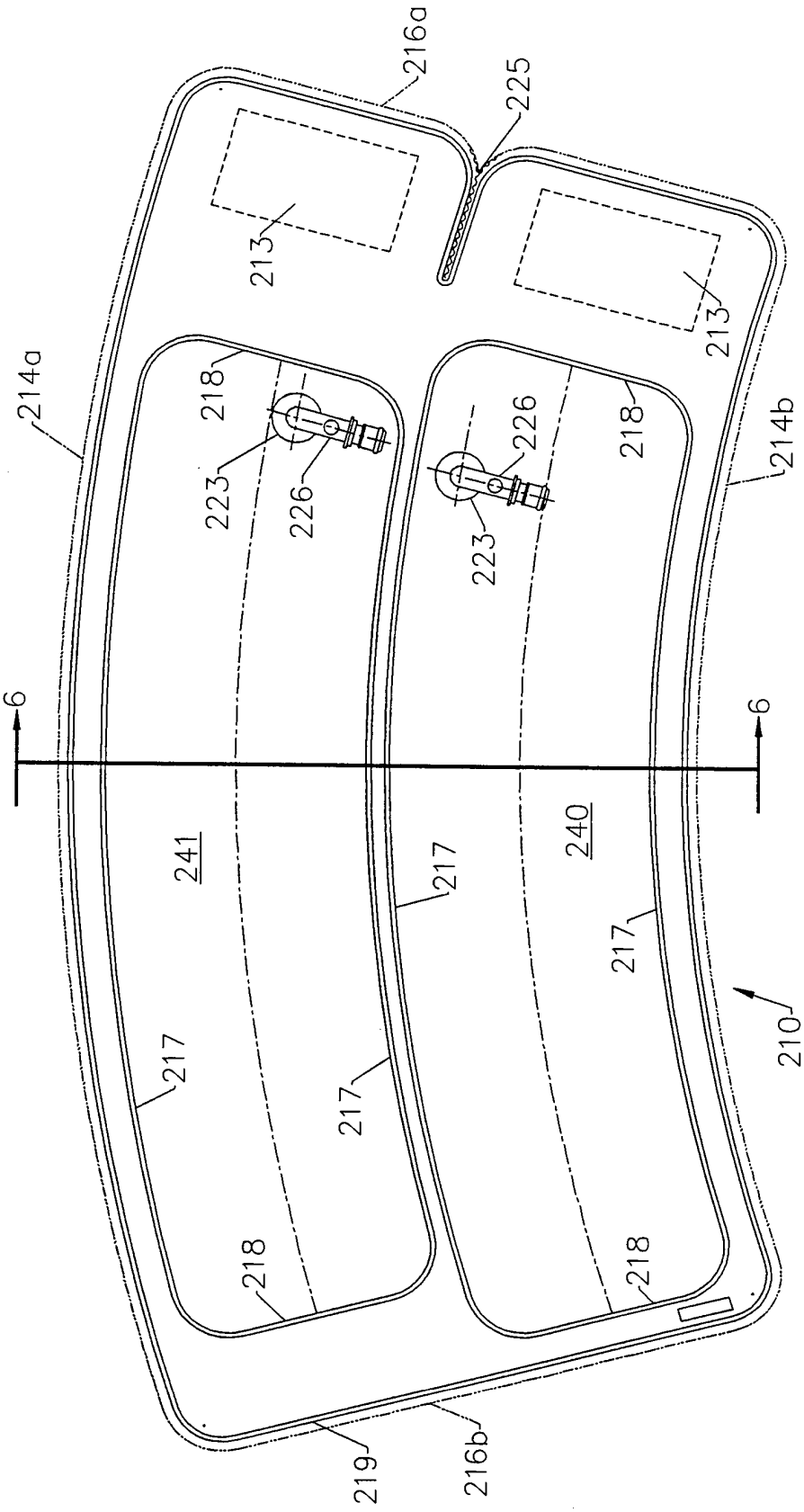
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FIG. 4.

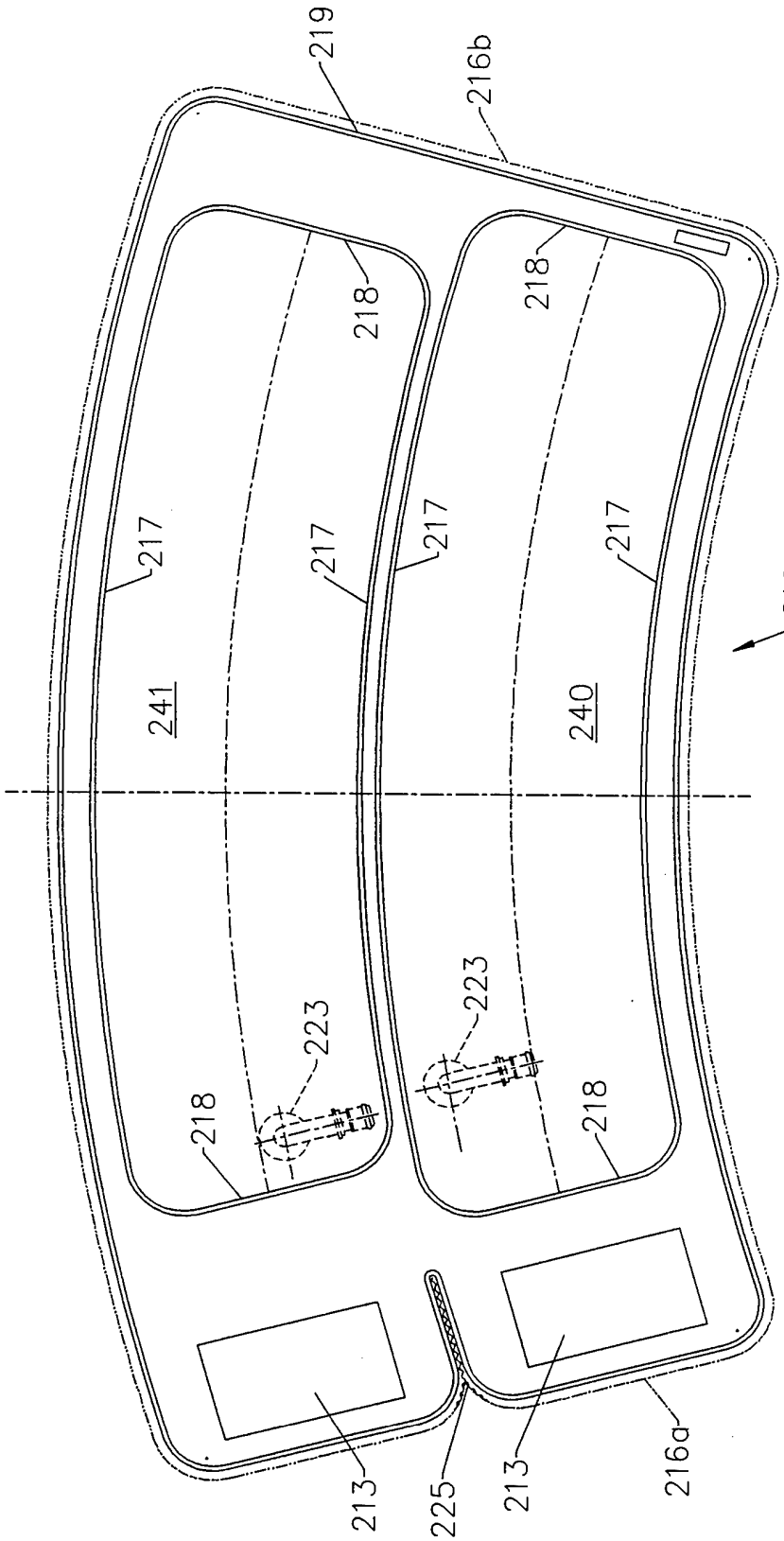
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FIG. 5.

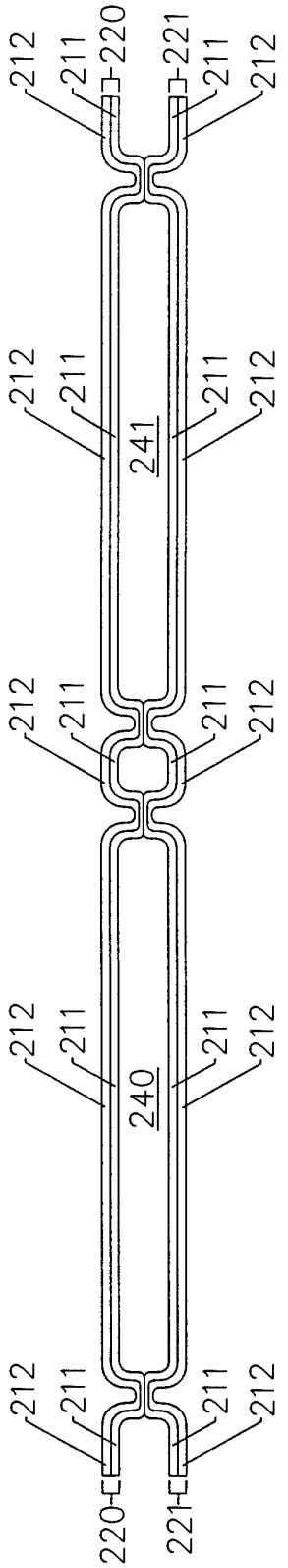

FIG. 6.

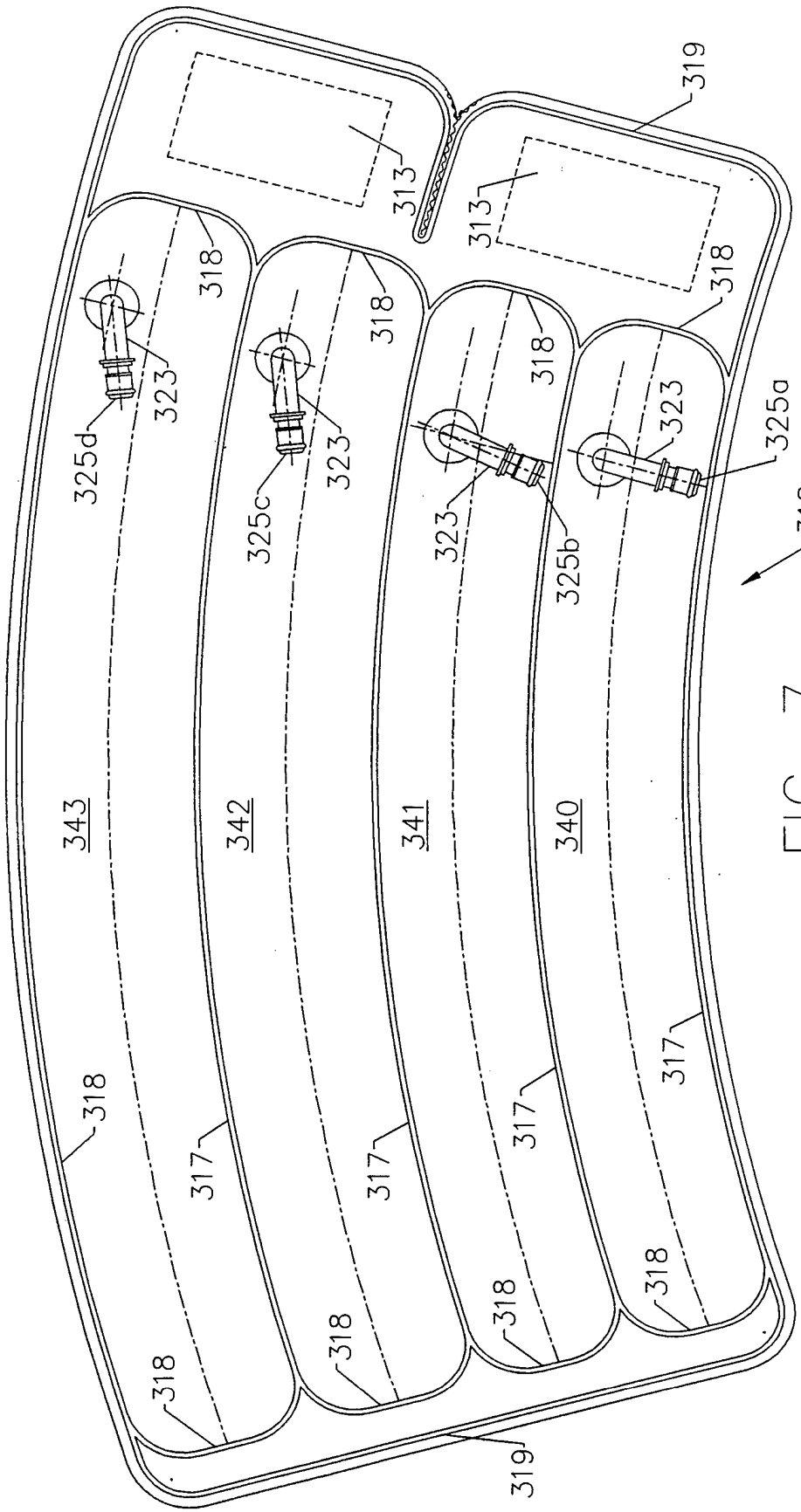
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FIG. 7.

INTERNATIONAL SEARCH REPORT

Interr al Application No
PCT/US 95/03646

A. CLASSIFICATION OF SUBJECT MATTER
IPC 6 A61H9/00

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
IPC 6 A61H

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US,A,4 280 485 (ARKANS EDWARD J) 28 July 1981	1-3,5-8, 10,11, 13,17, 20,22, 23,25, 27-29
Y	see column 3, line 6 - line 52; figures 1-9	4,9,12, 16,18, 19,21, 24,26

Y	US,A,4 597 384 (WHITNEY JOHN K) 1 July 1986 see column 3, line 13 - line 18; figures 1,2	4,12,16, 26

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[X] Further documents are listed in the continuation of box C.

[X] Patent family members are listed in annex.

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"&" document member of the same patent family

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Date of the actual completion of the international search	Date of mailing of the international search report
19 July 1995	03. 08. 95

Name and mailing address of the ISA	Authorized officer
European Patent Office, P.B. 5818 Patentlaan 2 NL - 2280 HV Rijswijk Tel. (+31-70) 340-2040, Tx. 31 651 epo nl, Fax (+31-70) 340-3016	Jones, T

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INTERNATIONAL SEARCH REPORT

Interr al Application No
PCT/US 95/03646

C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	EP,A,0 388 200 (KENDALL & CO) 19 September 1990 see column 12, line 13 - column 13, line 48; figures 1-5	9,18,19, 21
Y	US,A,4 773 397 (WRIGHT EDWARD S ET AL) 27 September 1988 see column 4, line 31 - line 34; figure 1	24
A	US,A,4 402 312 (VILLARI FRANK K ET AL) 6 September 1983 see column 3, line 28 - line 43; figure 2	14,15

1

INTERNATIONAL SEARCH REPORT

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PCT/US 95/03646

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		AU-B-	628917	24-09-92
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		DE-D-	69012381	20-10-94
		DE-T-	69012381	11-05-95
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		AU-B-	624898	25-06-92
		AU-A-	4913090	18-10-90
		CA-A-	2009834	12-10-90
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		EP-A-	0392670	17-10-90
		ES-T-	2053102	16-07-94
		JP-A-	3149047	25-06-91
		AU-B-	629293	01-10-92
		AU-A-	4913290	18-10-90
		CA-A-	2009832	12-10-90
		EP-A-	0392669	17-10-90
		JP-A-	3029656	07-02-91
		AT-T-	109344	15-08-94
		AU-B-	623497	14-05-92
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PCT/US 95/03646

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US-A-4402312	06-09-83	NONE	